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SUBMITTAL OF CHANGE PAGES FOR REVISION 0.3 OF THE SITEWIDE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT QUALITY ASSURANCE PROJECT PLAN

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LETTER

Department of Energy
Fernald Environmental Management Project
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MAR 14 1995

DOE-0710-95

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - 5HRE-8J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

SUBMITTAL OF CHANGE PAGES FOR REVISION 0.3 OF THE SITEWIDE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT QUALITY ASSURANCE PROJECT PLAN

This letter formally transmits the change pages corresponding to Revision 0.3 of the Sitewide Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ), Enclosure 1, for your review and approval.

Revision 0.3 consists of changes made to the Glossary, and Appendices B, J, and K. Theses changes reflect modifications in two field methods: 1) well installation and 2) micro-purge sampling techniques. In addition, some minor clarification was made to text supporting these two areas. All text changes are reflected by shaded text in the change pages. The change to Appendix B is the replacement of a figure illustrating well installation.

If you or your staff have any questions concerning this transmittal please contact Randy Janke at (513) 648-3123.

Sincerely,

Johnny Reising

for Jack R. Craig
Fernald Remedial Action
Project Manager

FN:RCJanke

Enclosures: As Stated

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TERMINOLOGY (cont.)

Consent Agreement. The U.S. Department of Energy and the U.S. Environmental Protection Agency entered into the Consent Agreement in April 1990; it was amended in September 1991. The Consent Agreement, which specifies actions to be taken at the FEMP, includes defining Operable Units (OU); conducting Removal Actions (RA), Remedial Investigations (RI), and Feasibility Studies (FS); preparing Records of Decision (ROD); and implementing Remedial Design (RD) and Remedial Actions (RA). The goal of the Consent Agreement is remediation of the FEMP with oversight from the EPA.

Contaminant. A contaminant is any physical, chemical, biological, or radiological substance or matter that has an adverse affect on air, soil, or water.

Contractor. The contractor is the organization that the DOE has appointed to function in a specific capacity at the FEMP and reports to the DOE or its designee. At the FEMP, the contractor is the Fernald Environmental Restoration Management Company, a wholly-owned subsidiary of Fluor-Daniel Incorporated. The DOE is utilizing the Environmental Restoration Management Contractor concept at the FEMP.

Data Package. See Sample Delivery Group.

Data Qualifiers. Data qualifiers are specifically defined letters, groups of letters, and symbols used by data validators to qualify the useability of data.

Dedicated Equipment. Dedicated equipment are systems exclusive to a location or purpose.

Designated FEMP Quality Assurance Organization. The quality assurance group of the ERMC is designated by DOE to be responsible for oversight of QA functions of contractors and subcontractors on-site. The designated FEMP Quality Assurance Organization may utilize Quality Assurance Resources of other contractor and subcontractor organizations to fulfill its duties.

Designee. A designee is an individual designated to perform a function in place of the defined responsible individual. The delegation of authority to a designee must be documented in the project record and must include the scope and length of time the delegation is in effect.

Deviation. A deviation is any departure from a specified requirement; it is used interchangeably with nonconformance. It can be a condition in which a characteristic of an item does not conform to prescribed limits, a required document is not available or is inadequate, a regulatory requirement was violated, or a procedure does not yield desired results.

TERMINOLOGY (cont.)

Duplicate. A duplicate may be a second analysis (or count) of the same sample (duplicate analysis) or identical analyses of two samples that were obtained from a single sample (duplicate sample).

TERMINOLOGY (cont.)

Laboratory Project Manager. This individual is employed by a laboratory and is responsible for overseeing the analysis and reporting of all samples from FEMP for a particular program or project. The laboratory project manager is also responsible for day-to-day liaison with the FEMP project contact.

Leachate. Natural leachate is liquid that has percolated through solid waste and dissolved soluble components, and any liquid, including any suspended components in the liquid, that has percolated through or drained from waste materials. In a laboratory setting, leachate refers to the result of TCLP extraction.

Losing Stream. A losing stream is influent with respect to groundwater (i.e., there is a net loss of stream water to the groundwater system). The hydraulic head of the stream surface has a greater potential than the surrounding groundwater environment, so the stream water contributes recharge to the aquifer.

Lower Limit of Detection. The LLD is the minimum count rate that can be routinely detected (radionuclide analyses).

Matrix Spike. The matrix spike is a known concentration of a spiking substance that is introduced into a sample to provide information about the effect of the sample matrix on the digestion and measurement method and on the accuracy of the result.

Method Blank. A method blank is prepared with the same reagents and put through the same processing as the samples.

Micro-Purge. Micro-purge is a method for low flow, low volume representative groundwater sampling.

Minimum Detectable Activity. The MDA is the smallest quantity of a radionuclide that can be detected in a sample with a 95 percent confidence level.

Monitoring Well. This is a well installed in a selected location and screened at a specific depth to allow monitoring of chemical and hydraulic parameters of the groundwater and aquifer. Wells are sequentially numbered and designated by the first digit in the well number according to the hydrogeologic zone in which they are screened. Type 1 wells are screened in the glacial till. Type 2 wells are screened across the top of the Great Miami Aquifer. Type 3 wells are screened in the general middle of the aquifer. Type 4 wells are screened ten feet above underlying bedrock.

TERMINOLOGY (cont.)

National Priorities List. The EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using Superfund. The list is based primarily on the site's Hazardous Ranking System score. The FEMP was added to the NPL in 1989.

TERMINOLOGY (cont.)

Standard Purge. A standard purge is a high volume or high flow method for obtaining a representative groundwater sample.

Stream. A stream is any body of flowing water or other fluid.

Subcontractor. A subcontractor is an individual or organization that performs a service for the FEMP while contracted to the ERMC.

Surface Water. Surface water is open to the atmosphere and subject to surface runoff.

Surveillance. Equivalent to an EPA performance audit, a surveillance is a spot check of program implementation to determine conformance to specified requirements.

Teflon. Teflon is a fluorocarbon plastic manufactured by the DuPont Corporation. In this document, teflon refers to any fluorocarbon plastic.

Tracer. A tracer is a small quantity of a (usually) pure radionuclide, different than those of interest, but expected to behave similarly (i.e., is added to a sample to determine the effect of processing and to derive a correction factor if necessary).

Tremie Line Method of Grouting. The tremie line method involves inserting grout into a borehole to ensure that there are no void spaces. A hose or pipe is inserted into a borehole to within five feet of the bottom of the opening. Grout is pumped through the hose or pipe. As the borehole fills, the tremie line is retracted at approximately the same rate as the hole is filling.

Unconfined Aquifer. Also called water table aquifer, an unconfined aquifer has no confining beds between the zone of saturation and the surface.

Unsaturated Zone. The unsaturated zone is between the land surface and the water table. It includes the root zone, intermediate zone, and capillary fringe. The pore spaces contain water at less than atmospheric pressure, as well as air and other gases. Saturated bodies, such as perched groundwater, may exist in the unsaturated zone.

Waste stream. This is a term used to describe waste leaving a facility or operation.

Appendix J FIELD ACTIVITY METHODS

APPENDIX J

FIELD ACTIVITY METHODS

J.1 PURPOSE

This appendix prescribes field methods for producing data in compliance with DOE and EPA requirements and meeting Data Quality Objectives (DQOs) for the FEMP.

J.2 SCOPE

General procedures for field activities are provided in subsection J.4 as follows.

- Daily Logs (paragraph J.4.1)
- General Drilling Practices (paragraph J.4.2)
- Well Design, Construction, and Abandonment (paragraph J.4.3)
- Well Development (paragraph J.4.4)
- Geophysical Surveys (paragraph J.4.5)
- Aquifer/Permeability Testing (paragraph J.4.6)
- Well Maintenance (paragraph J.4.7)

Additional procedures may be provided in the Project-Specific Plans (PSPs) to provide detailed instructions applicable only to the specific project.

J.3 RESPONSIBILITIES

J.3.1 FEMP Project Manager

The FEMP Project Manager shall be responsible for safe and prompt completion of project activities and for securing permits required by state, local, or on-site authorities. Underground and above-ground utilities shall be located and avoided to protect drilling operations personnel from danger. Copies of permits and other applicable documentation shall be posted on site whenever drilling operations are being conducted.

J.3.2 Geologist In Charge

The geologist-in-charge, who may be a geologist, hydrogeologist, or geological engineer experienced in well installation and development, shall be present during all drilling, installation, and development activities. The geologist-in-charge shall be responsible for documenting all activities related to drilling, installation and development of wells as outlined in Sections J.4.1, J.4.4.7, and J.4.6. Additionally, this person shall also have documented applicable field instrument (pH, specific conductivity, turbidity and temperature meters, combination meter, etc.) operation and calibration training.

The geologist-in-charge shall be responsible for preparation of subsurface boring logs that shall be generated for each boring, for complete and accurate generation of a daily log of project activities, and for preparing lithologic logs in the field.

J.4 PROCEDURES

J.4.1 Daily Logs

A daily log is a written record of activities and measurements conducted in the field by a team on a given date and may include daily field activity logs, boring logs, well-construction logs, media-specific sampling logs, photographs, and sketches. The log shall be in a bound book with printed, sequentially numbered pages or on sequentially numbered, printed daily log forms as specified by the PSP.

J.4.1.1 Daily Log Entries. The geologist-in-charge is responsible for entries in the daily log, which shall include, but not be limited to, the following information as applicable.

- Subject of field activity
- General work activity
- Unusual events
- Changes to plans and specifications
- Visitors on site
- Time, depth, and identification number of samples
- Chain-of-custody tracking number
- Surveillance observations and findings

- Calibration checks
- Subcontractor progress and specifications
- Communication with regulatory agencies or others
- Weather conditions

J.4.1.2 Lithologic Logs. The geologist-in-charge is responsible for preparing lithologic logs in the field that provide the following information at a minimum.

- Footage drilled
- Materials penetrated
- Depth to significant changes in lithology
- Samples collected (identified by depth, sample number, and collection method)
- Qualitative degree of saturation of each sample
- Depth to saturated zones and potential confining beds
- Fluid losses
- Surface casing used and method of installation
- Zones of unusual pressure gradients

An example of a lithologic log form is provided in Form J-1 in Appendix B.

J.4.1.3 Types of Field Activities. Daily entries in logs shall include, but not be limited to, the following types of field activities as applicable to the project.

- Footage drilled
- Materials used
- Sample collection start and completion times
- Samples collected
- Description of samples
- Bottom casing depth

- Surveys conducted
- Decontamination activities
- Well construction
- Aquifer testing
- Special activities
- Well installation activities
- Unusual occurrences

J.4.1.4 Daily Log Completion. The following procedures shall be performed.

1. Record all field measurements and comments (see J.4.1.1 - J.4.1.3) using black ink in the appropriate field logs, or on daily log forms as specified by the PSP. If the information requested on a form is not applicable, or is not known, insert an "NA" (not applicable) or "NK" (not known) as appropriate. Line out any unused portions of the form by drawing a line through the empty area, and initial and date. As each form is completed, initial and date each page.

2. If steps or procedures were not performed as described in the PSP, a varience (see Section 15.4) must be initiated. State the reason for the deviation as completely as possible on the field form, or document the reason for the deviation on an attachment. Reference the varience number on the field form.

3. Identify photographs with project number, date and time taken (using 24-hour time), and a brief description on the back.

4. Place identified photographs in an album in easily retrievable fashion and file.

NOTE

Information in activity-specific logs shall not duplicate other required documentation but rather support it.

5. As part of the daily log, generate activity-specific logs (e.g., subsurface boring logs, water sampling logs, sediment sampling logs) to document field conditions.

J.4.1.5 Filing Requirements. The following documentation of field activities shall be filed as indicated. These copies will provide adequate documentation of work activities if originals are destroyed, lost, or stolen.

1. Send photocopies of daily log entries to the FEMP project manager or representative and others as required at least weekly.

2. Maintain originals of field records in the project central file. Keep photocopies of bound books in the central file until the book is complete and entered in the file system.

3. During performance of field program, maintain copies of field records in FEMP project manager file.

J.4.2 General Drilling Practices

The number, location, depth of borings, type of sampling and testing required are dependent on intended use of the data. The type of drilling method selected for a particular project at the FEMP depends on the intended use of the borehole and samples collected. Ability to acquire data of sufficient quality for intended use and personnel health and safety are primary factors considered when selecting a drilling method.

Guidelines for determining a particular drilling method shall be presented in PSPs. The FEMP project manager is responsible for determining that the drilling technique used is appropriate for site conditions and project objectives. The chosen drilling method shall reflect the FEMP policy of waste minimization. Drilling methods that may be selected include, but are not limited to, the following.

- Hand augering (to 8 ft. or less below the ground surface)
- Rotasonic
- Cable-tool
- Hollow-stem auger
- Drive casing
- Spin casing
- Direct mud rotary
- Air rotary with casing driver
- Air rotary with swing-out, under-reaming bit and casing advancer
- Reverse-air or mud rotary

Drilling operations shall be conducted as follows.

1. Decontaminate drilling equipment before each use as specified in Appendix K to prevent contamination of the borehole and after each use to prevent off-site transport of contaminants.

2. Minimize introduction of contaminants into the environment and spreading of contaminants between zones.

3. Set surface casing when a potentially contaminated zone is drilled prior to reaching the target zone.

4. When drilling to install any type of well through areas where near-surface contamination is indicated from past experience or during screening of samples while drilling, grout surface casings in place and make them part of the permanent installation. The borehole diameter shall be at least four inches larger than the diameter of the surface casing to allow for an adequate grout seal. (see Section J.4.3)

5. In outlying areas not suspected of being contaminated, advance large diameter temporary casings as necessary for bore-hole control.

6. Minimize production of fluids, cuttings, and other waste by using above-ground mud pits, drums, or plastic-lined structures for containment of drilling fluids and cuttings unless otherwise specified in the PSP.

NOTE

> The FEMP potable water system is the approved water source for FEMP drilling operations.

7. Use only an approved water source during drilling operations.

NOTE

> The use of additives in drilling fluids is discouraged except in unusual circumstances.

8. If an additive is to be used, obtain prior approval from the FEMP project manager.

9. Analyze a sample of the additive for parameters of interest, and review analysis results for potential impact on objectives of the data-collection program.

10. Collect cuttings or core samples at frequency specified in the PSP in accordance with the requirements for subsurface soil sampling in Appendix K.

The geologist-in-charge shall include in the daily log the information specified in paragraph J.4.1.2 and prepare lithologic logs in the field that provide the required information.

J.4.2.1 Borehole Abandonment. The objectives of borehole abandonment include:

- Elimination of physical hazards
- Prevention of groundwater contamination
- Conservation of aquifer yield and hydrostatic head
- Prevention of intermixing of subsurface waters
- Compliance with reasonable property owner requests
- The well is no longer necessary to support FEMP project activities
- The well, for whatever reason, does not yield groundwater data representativ of conditions in the monitored hydrogeologic zone

Approval of PSPs and acquisition of penetration permits will imply approval to plug and abandon soil borings immediately after sample collection. No additional abandonment permits are required. Borehole abandonment shall be completed as soon as possible following completion of sampling objectives. Precautions will be taken to mechanically secure the borehole during work stoppages of more than two hours.

J.4.2.1.1 Hand Augered Boreholes. Hand augered boreholes will generally be limited to four inches or less in diameter and eight feet or less below the ground surface, depending on physical location and lithologic materials present in the subsurface. The following procedures shall apply when abandoning a hand augered boring.

1. For borings no greater than one foot deep, backfill and compact in-situ materials not used for sampling and re-grade using a shovel or trowel with surrounding materials to complete the backfill.

2. For consolidated materials, attempt to remove all loose or caved-in materials using a hand auger/bucket. For unconsolidated materials, allow collapsing and caving to occur and attempt to tamp loose material toward the bottom of the hole with the auger/bucket assembly.

3. Hydrated bentonite pellets, volclay grout, cement, or a combination of these materials will be used to plug and abandon the hole to within 30 inches of the surface.

Bentonite, volclay grout, cement, or a combination, will be poured into the boring in increments of approximately two feet. For bentonite pellets, equal volumes of deionized water will be poured over each increment of bentonite, allowing several minutes between increments for adequate hydration of the pellets to occur. The top 30 inches will then be backfilled, compacted and graded with surrounding top soil or in-situ surface materials.

J.4.2.1.2 <u>Rig Drilled Boreholes</u>. Rig drilled boreholes are generally conducted at depths greater than eight feet, but may be used at any depth when projects require large diameter borings. Procedures for abandoning borings greater than ten inches in diameter will be specified in PSPs; for rig-drilled borings of ten inches or less, the following procedures shall apply.

1. Volclay grout shall be used for plugging unless otherwise specified in the PSP.

2. For boreholes completed in dry, stable materials, drill augers and casings may be removed and grout inserted from the bottom of the hole using a tremie line.

3. For boreholes completed in unstable materials, use the drill augers or casing to prevent the collapse of the boring as the grout is inserted. Maintain a grout level a minimum of 10 feet above the bottom of the drill augers or casing as the grout is inserted and the drill augers or casing is/are removed.

4. Boreholes will be filled with Volclay grout to within six inches of the surface. After allowing the grout to settle (about 24 hours), the remaining open hole will be marked with a steel pin and filled with concrete to the surface.

J.4.3 Well Design, Construction, and Abandonment

For clarity, the term "well" shall include groundwater sampling points such as four-inch diameter monitor wells, above-ground and surface-finished piezometers, and former production wells.

The FEMP project manager is responsible for locating wells and for selecting the appropriate portion of an aquifer so that project objectives defined in the PSP are met. The geologist-in-charge is responsible for overseeing well installation in the field and for properly documenting construction details. Additionally, the geologist-in-charge, or FEMP Project Manager, must forward all boring logs related to well installation to the Ohio Department of Natural Resources.

The following procedures are required to ensure quality control of well design and installation and successful completion of field drilling investigations for hydrogeological and future water quality information.

J.4.3.1 Well Design. Use the following materials for construction of wells.

1. Use 316 stainless-steel well casing with flush-thread joints below the water table.

NOTE

Use of glues or solvents is prohibited.

2. Use schedule-40 PolyVinyl Chloride (PVC) or 316 stainless-steel casing with flush-thread joints for piezometers and above the water table in wells if preferred. The casing type selected depends on the presence of known or suspected contaminants and the proposed depth.

3. Use two to fifteen-foot sections of commercial wire-wound stainless steel screens with flush-thread joints compatible with the well casing (minimum three square inches open area per foot of screen). Determine size of screen openings based on effective grain size of monitored zone and filter pack size suggested by Aller (1989), or by using data obtained from previous wells that are screened in similar geologic formations and located adjacent to the well being placed.

NOTE

Screen openings shall be capable of catching between 85 and 100 percent of filter pack materials to allow accurate measurement of hydraulic properties, minimize turbulence during sample collection, and optimize capacity to develop the well completely and efficiently. Slotted or wound PVC screens with flush-thread joints compatible with the well casing may be used in piezometers. However, hydraulic data collected from piezometers shall be carefully evaluated to determine whether measurements are representative of the aquifer or of well materials.

4. Use well-sorted quartz sand for filter pack material.

NOTE

Selection of filter pack grain size is a function of grain size distribution in the natural formation and should be based upon sieve analysis (Driscoll 1986) unless historical data is used.

5. Prior to the use of any filter pack material, the materials used must be inspected to ensure that they have not been compromised and that work plan requirements are met.

NOTE

Typically, graded sand meeting requirements of American Society for Testing and Materials C-33 for fine aggregate (concrete sand) is sufficient.

6. Describe each filter pack sample in terms of lithology, grain size distribution, and source (company where purchased, lot number, and pit or quarry of origin). Place description in project files.

7. An overlying filter pack seal, consisting of bentonite pellets or bentonite grout for any well type, will be placed in the annulus directly above the filter pack in wells screened across the water table. Use pellets one-quarter to one-half inch in diameter.

8. Record brand name and lot numbers of bentonite in project files.

9. Annular grout must consist of a slurry of high-solids bentonite (e.g., Volclay) mixed to manufacturer specifications. Volclay grout mixtures used to seal the annular space must conform to the density standard of 9.4 lb/gal. Grout density will be verified by mud balance measurements prior to and during placement of the grout. If grout density in the annulus in less than required, then the grout shall be pumped from the annulus until the 9.4 lb/gal standard is reached. Any grout purged from the annulus of the well shall be managed in accordance with applicable FEMP requirements.

10. The top 30 inches of annular space shall be sealed with concrete. The concrete will be placed over the grout seal. The protective casing will be placed in the concrete seal before the concrete sets up. The concrete seal shall have a minimum height of 2 inches above the land surface and 2 inches below grade and shall extend a minimum of 12 inches from the protective casing. The surface seal shall be sloped sufficiently to drain surface water away from the well. Applicable hot and cold weather concrete placement methods will be specified in the site monitoring well installation procedures. Form J-2 (Appendix B) is a typical FEMP monitoring well construction diagram.

11. FERMCO Quality Assurance will inspect the physical installation of monitoring wells installed at FEMP by utilizing the following criteria before and during well construction:

   a. Borehole depth and diameter are consistent with Project Specific Plans (PSPs).

   b. Materials used for construction of each monitoring well must meet specifications of the SCQ and/or as directed in the PSP (i.e. proper size and type).

   c. Materials are installed in monitoring well in accordance with SCQ requirements and/or as directed in the PSP.

d. Annular grout entering the borehole has been density tested using a mud balance, and is consistent with SCQ requirements.

12. Reserve a sample of each type, brand, and size of backfill material used during the project for potential analysis of contaminants of interest.

J.4.3.2. Well Construction. Immediately (within 8 hours) after drilling is complete and the borehole has been cleaned of cuttings, construct well as follows.

1. Quality Assurance will measure/verify materials to be used for construction of each monitoring well for proper size per specification (i.e., filter pack material, screen length and slot size, casing length, etc.).

2. Place desired length of screen and casing inside open borehole, temporary casing, or hollow-stem augers.

3. Place filter pack in annular space between screen/casing and temporary casing or augers by the tremie line method as follows.

    a. Insert a small diameter pipe to the desired depth.

    b. Fill annular space by pouring the sand filter pack in place through the tremie pipe.

    c. Raise the tremie pipe so that it remains 0.5 to 3 feet above the top of the filter pack.

4. Make periodic measurements to check uniform placement of filter pack.

5. Record depth to top of filter pack to nearest 0.1 foot.

6. Remove temporary casing gradually and install backfill materials so that bottom of the temporary casing is kept below the top of backfill material.

7. Backfill glacial drift wells and wells screened across water table of the regional aquifer (Type 1 and Type 2 wells) as follows.

    a. Install a filter pack to a height of two to five feet above the screen.

    b. Place a five-foot sodium bentonite pellet plug on top of filter pack.

    c. Hydrate pellet seal with five to ten gallons of water.

    d. Install a high-solids bentonite slurry from the top of bentonite plug to within

30 inches of the land surface by side-discharge tremie line method.

8. Backfill wells screened in the middle and at the bottom of the regional aquifer (Type 3 and Type 4 wells) as follows.

   a. Install a filter pack to a height of approximately three to five feet above the screen.

   b. If a coarse filter pack is used, place approximately three feet of 60 mesh or finer sand on top of the filter pack.

   c. Place a high-solids bentonite grout to within 30 inches of ground surface using a side-discharge tremie line method.

NOTE

Place well caps on the well casing prior to grout placement. Grout purged from the borehole cannot be reused.

9. For above ground completions, finish top of well casing with 24 to 30 inches of casing stickup, a vented stainless-steel cap, or an airtight cap and vent hole not more than six inches from top of casing.

10. Finish ground-flush completions with an airtight cap.

11. File a notch approximately one-quarter inch deep at top of each well casing, measure elevation of base of notch, and reference each water-level measurement to the elevation.

12. Install the following minimum protection around wells.

    a. Ground-flush installations

       (1) Ensure that completions are either water tight or free-draining (containing a drainage layer of coarse sand at the bottom of the flush-mount box).

       (2) Provide a well cap with lock.

       (3) Install a protective cover secured with bolts that prevent precipitation from entering the protective casing.

       (4) Install manhole-type boxes large enough to accommodate the well casing, well cap, and a lock.

b. Above-ground installations

(1) Use a five-foot-long black iron pipe, minimum one-quarter-inch thick, and at least four inches greater in diameter than the well casing as a protective casing.

(2) Place well casing within four inches of top of protective casing.

(3) Fit protective casing with a hinged cap, hasp, and lock.

(4) Drill a drain hole in the oversleeve one foot above land surface.

(5) Place a mixture of cement, sand, and potable water in a ratio approximately 1:4:0.5 (by weight) between well riser and outer protective casing to a height just below the drain hole to allow water entering the annulus to drain.

(6) The top 30 inches of annular space shall be sealed with concrete. The concrete will be placed over the grout seal. The protective casing will be placed in the concrete seal before the concrete sets up. The concrete seal shall have a minimum height of 2 inches above the land surface and 2 inches below grade and shall extend a minimum of 12 inches from the protective casing. The surface seal shall be sloped sufficiently to drain surface water away from the well. Applicable hot and cold weather concrete placement methods will be specified in the site monitoring well installation procedures. Form J-2 (Appendix B) is a typical FEMP monitoring well construction diagram.

c. All installations

(1) Paint protective casings with high-visibility orange paint. The ambient temperature must be within manufacturers specifications before applying paint.

(2) Mark well location on well protector in three places as follows.

- On inside of cover with enamel-type paint
- Welded, stamped, engraved, or permanently painted on top of locking cover or flush-mount cover
- Engraved or marked with indelible marker on outside of well cap.

NOTE

Guardposts are necessary in high traffic areas, where vegetation or debris obscures the well casing, or as specified in the PSP.

(3) Guardpost installation shall be structurally independent of any concrete surface seal. The guardposts shall be steel, filled with concrete or I-beams, and located radially around the well at four-foot intervals. The posts shall be driven into the ground, requiring no excavation. They shall be set four feet below the ground surface and approximately three feet above the ground surface.

Regrade with drainage away from well head, and restore disturbed drilling areas to as close to original condition as possible.

NOTE

Well completion logs shall be graphically and descriptively accurate and shall contain information pertinent to the specific well that the log represents.

13. Prepare a well completion log containing quality items consistent with form J-2, Appendix B, including the following.

- A sketch of each well installation showing the following.
    - Bottom of the boring by depth from surface grade
    - Screen location
    - Granular backfill, seals, grout, and cave-in
    - Centralizers if used
    - Top of riser relative to ground surface
    - Details of well protection and above-ground completion
- Composition of grout, seals, and granular backfill
- Screen length, slot size (in inches), and slot configuration (wound or machine slotted)

J.4.3.2.1 Cold Weather Concrete Placement. The following conditions shall apply to the placement of concrete for monitoring well pads when temperatures are below 45° F.

- The use of salts and chemicals to effect cold weather placement shall not be permitted.
- All ice, snow and frost shall be completely removed from surfaces that will be in contact with concrete before the concrete is placed.
- Concrete shall not be placed on a frozen subgrade or on a subgrade that contains frozen materials. If placements are to be made during freezing weather (32° F or less), the ground upon which the concrete is to be placed shall be heated for 12 hours at a minimum before any concrete is placed.
- Concrete shall be protected from freezing by adequate covering for seven days.

J.4.3.3 Dedicated Equipment. Use of dedicated groundwater sampling equipment is encouraged. Types of equipment that may be dedicated to a sampling location include, but are not limited to, the following.

- Bladder-type sampling pumps
- Submersible impeller-type purge pumps
- Submersible piston-type purge pumps
- Packers
- Hoses
- Water-level measurement equipment

The following procedures apply when installing, maintaining, and using dedicated sampling equipment.

NOTE

Equipment that requires special handling, shall be installed and maintained only by manufacturer-trained personnel.

1. Dedicated sampling equipment is not to be removed from the well except for when maintenance is to be performed on either the sampling equipment or the well. Store designated sampling equipment, such as bailers, in the well casing between uses or pull it from the well and store it in a designated storage structure. If stored outside the well, identify the equipment by number of its designated well.

2. Decontaminate equipment removed from a well as specified in Appendix K prior to re-installation.

NOTE

Maintenance may include decontamination to remove mineral precipitation or biological growths.

3. Perform maintenance as specified by manufacturer or, if specifications are not available, on a set schedule based on past usage or when performance is declining.

J.4.3.4 Well Abandonment. The reasons for well abandonment include the following.

- Elimination of physical hazards
- Prevention of groundwater contamination
- Conservation of aquifer yield and hydrostatic head
- Prevention of intermixing of subsurface waters
- Compliance with reasonable property owner requests
- The well is no longer necessary to support FEMP project activities
- The well, for whatever reason, does not yield groundwater data representative of conditions in the monitored hydrogeologic zone

Specific well abandonment procedures depend on the conditions encountered at the well site. Individual procedures will be incorporated into the PSP. However, the following guidelines shall be taken into consideration when abandoning a well.

1. Complete a Well Plugging Abandonment and Request Form (Form J-3, Appendix B) prior to plugging and abandoning each well. Complete a well plugging and abandonment form after the completion of each plugging and abandonment activity.

2. If the well is to be abandoned with the casing and annular fill left in place, adequate evidence shall be provided in the PSP to prove that cross-contamination is not occurring or will not occur.

3. If well casings and screens must be removed for an adequate seal, remove them by pulling or overdrilling prior to grouting the borehole.

   a. If casing is to be overdrilled, the outside diameter of the drilling tool shall be at least as large as the original borehole.

b. If the screen and casing must be removed, continue overdrilling to bottom of original borehole, removing all annular fill material, before grouting.

4. Calculate the volume of grout needed to fill the borehole to a depth of 30 inches below grade.

NOTE

A density standard of 9.4 lb/gal shall be used for all grout mixtures. Grout density shall be measured in the field using a mud balance. Grout density shall be verified by Quality Assurance prior to filling the borehole.

5. Before removing the well casing and screen, first insert grout and then pull the casing to reduce borehole collapse and bridging below the well bore.

6. Place grout in the borehole, using the tremie method, from the bottom to the top.

7. Measure the actual volume of grout added. If significantly more grout is added than that calculated in step 5 (25 percent), stop grouting and consult the FEMP project manager.

8. Allow clay slurry grout to settle for 24 hours. If using cement grout, allow it to harden for 24 hours.

9. Use a concrete plug to fill at least the uppermost 30 inches of the borehole.

10. Insert a metal pin to mark the abandoned well site.

11. Record materials used and materials removed from the borehole.

12. Dispose of removed material as specified in the PSP for well abandonment.

J.4.4 Well Development

Wells shall be developed to yield accurate aquifer test results and groundwater samples representative of aquifer conditions. Well development may be conducted using bailers, submersible pumps, bladder pumps, or peristaltic pumps. Surging techniques using surgeblocks are recommended in relatively high-yield aquifers. Excessive drawdown must be avoided, reduce the purge rate if necessary.

The FEMP project manager shall specify the well development method in the PSP where sufficient historical data exists to make an informed decision. Where historical well development data are lacking, the well development method shall be based on observed aquifer response during drilling.

The following procedures apply when developing a well.

1. Decontaminate equipment and materials used for well development as specified in Appendix K before each use.

2. Develop well as soon as possible after well installation, but no sooner than 48 hours after grouting is completed.

3. Continue development until the water is visually clear and temperature, pH, and specific conductance have stabilized.

4. At a minimum, use the following well procedures.

    a. If the boring was made without use of drilling fluid water, remove five times the standing water volume in the well (water in well screen and casing plus saturated filter pack).

    b. If recharge is so slow that required amount of water cannot be removed in a reasonable amount of time, or the water remains discolored, or it contains visible particulates after the five-volume removal, contact the FEMP project manager or representative for direction to use an alternate procedure based on recommendation of the field representative.

    c. If it appears necessary to add water to the well to assist development, obtain written approval from the FEMP project manager before proceeding.

NOTE

Do not use chemicals (e.g., dispersing agents. disinfectants, or acids) during well development.

    d. If the boring was made or enlarged using drilling fluid (water), remove five times the measured amount of total fluids lost while drilling plus five times the standing water volume. If slow recharge, discolored, or particulate-laden water is a problem, proceed as in step b.

5. During development, attempt to remove standing water over the entire length of the screen and from the top of the water column.

6. If construction errors or contamination are suspected during development, promptly notify the FEMP project manager or representative for disposition.

NOTE

In cases where grout degradation/contamination is suspected, monitoring data will be evaluated to identify indicators such as elevated pH, sodium, calcium, aluminum and other cations. In addition, FEMP personnel may evaluate and use, where appropriate, methods such as X-ray diffraction and sonic geophysical logging to determine grout degradation/contamination.

7. Record field measurements and comments on applicable data field forms. If some steps or procedures are not performed as specified, state the reason for the deviation as completely as possible on the form or document the reason for the deviation on an attachment. If a varience (see Section 15.4) was initiated for the deviation, reference the varience number on the field form. Include the following data on the form:

   a. Well designation (location ID)

   b. Date of well installation

   c. Date and time of well development (start and finish)

   d. Static water level before and after development

   e. Quantity of water removed and time of removal

   f. Depth to bottom of the well inside the casing before and after development

   g. Physical character of removed water including changes during development of temperature, turbidity (nephelometric turbidity unit [NTU]), pH, specific conductance, color, and odor at regular intervals

   h. Physical characteristics of removed sediments including lithology and grain size

   i. Descriptions of equipment used including type and size/capacity of pump and/or bailer used

   j. Description of surge techniques used

J.4.5 Geophysical Surveys

Geophysical methods shall be chosen based on project objectives. See Environmental Protection Agency (1987) for a brief description of commonly used methods.

Specific techniques for conducting geophysical surveys by borehole logging or surface methods shall be provided in the PSP based on the following guidelines.

J.4.5.1 Borehole Geophysical Logging. Borehole geophysical methods are used to acquire information about subsurface geological characteristics such as the following.

- Formation breaks
- Thickness of individual beds
- Porosity
- Nature of borehole and formation fluids
- Identification of high-permeability zones
- Depth of penetration of drilling fluids
- Borehole size

A minimum of one quality control duplicate run shall be made with each tool used on each project where borehole geophysical logging is specified. When performance of the logging operation has met project objectives, the geophysical team leader shall sign and date completed logging forms (step 4).

The following procedure applies generally to geophysical surveys and logging of activities.

1. Clean and decontaminate downhole tools and cables prior to downhole logging operation and between each borehole as specified in Appendix K.

2. Calibrate logging equipment and provide the FEMP project manager with applicable documentation before and after survey calibrations.

3. Properly clean and decontaminate logging equipment at conclusion of operation.

NOTE

> The FEMP project manager or representative shall ensure that specified originals and copies of logs are placed in project files. The team leader shall record progress of logging activities.

4. Complete applicable forms and record unusual occurrences in the daily log as follows.

    a. Include remarks on the log header.

    b. Identify the log run on the log header.

    c. Enter logging speed, length of tool and resolution, borehole identification, and team member names on the log header.

d. Mark each curve on the log using a unique line format for every curve.

e. Mark the vertical scale in feet and record total depth of the borehole at the bottom of the log.

f. Identify and graduate the horizontal scale for each log run, labeling a minimum of every ten grid spaces horizontally on the log.

5. Transfer copies of data to the FEMP project manager or representative for distribution, analysis, and archiving. Transmit magnetic recordings generated during the course of downhole logging along with results of logging runs immediately. (Recordings shall be in a format specified by the FEMP project manager or designee.)

J.4.5.2 Surface Geophysical Surveys. Surface geophysical methods provide subsurface information without the need for excavation. Information that can be obtained includes the following.

- Delineation of contaminant plumes
- Identification of high-permeability zones
- Location of disposal areas
- Location of subsurface anomalies
- Identification of subsurface utilities and stratigraphic data

The PSP shall specify the geophysical method and instruments to be used, grid spacing, time frame for survey, information desired, and frequency of duplicating lines for quality control purposes.

A minimum of five percent of the total linear distance of the survey shall be duplicated. Provisions for verifying interpretations through use of borings or excavations shall be included in the PSP.

The following general procedures are applicable for surface geophysical surveys.

1. Operate instruments as specified in manufacturer instructions or in the PSP.

2. If manufacturer instructions are not used, provide justification for this variance as specified in Section 15.

3. Provide the following information on project-specific logging forms.

- Date of activity
- Times survey was begun and finished
- Times of breaks in activity
- Temperature variations
- Descriptions of variation from an established line caused by topography or vegetation; crossing of drainage features; crossing of swampy areas; instrument settings, calibrations, or malfunctions; and operators.

J.4.6 Aquifer/Permeability Testing

A decision to conduct an aquifer test for each project shall be made in accordance with guidelines in the PSP. Guidelines for determining test type, location, and objectives for each project shall also be specified in the PSP. Every aquifer test should be considered unique.

Following are requirements for hydraulic tests to characterize certain properties of hydrogeologic units (e.g., hydraulic conductivity, transmissibility, and storability). Data obtained during field hydraulic tests may include the following.

- Static water level
- Pumping well water discharge rate or volume of water displaced
- Drawdown or pressure versus time data for pumping and monitoring wells
- Water temperature, pH, and specific conductance
- Test interval

J.4.6.1 General Test Procedure. The following general procedure shall be performed in addition to procedure specified in the PSP.

1. Use equipment specified in the PSP based on approximations of the properties of interest from previous drilling and testing data.

2. Record the following information as applicable for each test.

   - Type of test (e.g., slug test, specific-capacity test)

- Type of data recorded (e.g., recovery or drawdown)
- Test well identification
- Identification and relative position of observation wells including a diagram
- Depth and length of screened or open interval
- Diameter of both well casing and boring
- Known or estimated thickness of the aquifer
- Static water level
- Start and completion times of test
- Start and completion times of pumping if applicable
- Drawdown versus time measurements
- List of equipment used including pumps, hoses, slugs, transducers, data loggers, and water level measurement devices
- Weather conditions including duration and intensity of precipitation
- Testing personnel

3. Maintain complete original test records in project files and make copies available to hydrogeologists and field representatives who performed the test.

4. Prepare a diagram of equipment used in each aquifer or permeability test (by the responsible hydrogeologist). Indicate the tubing dimensions, depth of water intake, and location of gauges and packers. Include the diagram in the data records of each test.

5. Calibrate gauges, flowmeters, and other instrumentation used and check for proper operation before use.

6. Obtain copies of calibration documentation from the instrument or testing service company; maintain calibration records consisting of laboratory measurements, and, if performed, on-site zero adjustment and/or calibration. Include these records in the project file.

7. If a weir or an orifice is used to measure flow volumes or rates, check these devices on site using a vessel of known volume and a stopwatch. Document accuracy before testing proceeds.

8. Install equipment and demonstrate to the hydrogeologist that it is in proper working order and performing to specifications before start of pumping test.

9. If past monitoring data indicate that the water does not contain hazardous constituents or possess characteristics of hazardous waste as defined by the Resource Conservation and Recovery Act, dispose of water pumped from the well during the aquifer or permeability test in the general sump and treat it in the FEMP wastewater system.

NOTE

> Direct questions about whether water from a certain well constitutes a hazardous waste to FEMP environmental compliance personnel.

10. Make special storage arrangements prior to removing water that may contain hazardous waste.

11. Decontaminate equipment used in boreholes, wells, or piezometers as specified in Appendix K prior to use and between each test site.

J.4.6.2 <u>Borehole Hydraulic Testing for Aquifer Characteristics</u>. The following procedures apply for determining hydraulic parameters of aquifers using slug tests and pumping tests. Generally, the procedures in paragraph J.4.6.1, steps 1 through 9, apply to both slug tests and aquifer pumping tests. If there are variations to the following procedures, they shall be specified in applicable PSPs.

Slug Tests - Slug tests are a quick and inexpensive method of estimating the hydraulic conductivity or transmissibility near the screened zone of the well.

1. Use the following equipment to conduct a slug test.

NOTE

> A number of water-level measuring devices may be used for measuring depth to water in a well. Accurate readings can be obtained with electric water-level indicators, pressure transducers, or weighted tapes. Avoid water-level measurement by the weighted-tape method except when conducting tests of intervals suspected of having a very low K value. It may be difficult to obtain enough readings for analysis of the tests if the

water level recovers quickly in a short period of time.

- Water level measuring device
- Known volume of slug (solid cylinder or volume of water added or removed) that will fit into the well, borehole, or container to add or remove a known volume of water
- Timer accurate to one second or a pressure transducer and data-logger combination
- Semi-log graph paper and indelible pen or pencil and paper or verified slug-test analysis software

2. Record the following information before beginning the test.

   - Site identification and well or borehole location
   - Location and elevation of reference point from which water depth measurements are made
   - Elevation of groundwater with respect to reference point
   - Date and time of test
   - Well depth, screen length, riser pipe radius, well screen radius, radius of gravel pack plus well screen or borehole depth and radius
   - Thickness of groundwater zone to be tested
   - Volume of slug added or removed
   - Type of measuring device used
   - Names of personnel conducting test

3. Determine static water level in well by periodically measuring depth to water for several minutes and taking average of readings.

NOTE

It is important to remove or add the volumes as quickly as possible because the analysis assumes that an instantaneous change in volume is created in the well.

4. Instantaneously introduce or remove a slug of known volume to displace water level.

NOTE

> The number of depth/time measurements necessary to complete the test are variable, but it is critical to make as many measurements as early as possible in the test.

5. Assign time zero to the moment of volume addition/subtraction, measure, and record depth to water and time of each reading. Measure depth to the nearest 0.01 foot.

NOTE

> Time required for slug test completion is a function of volume of the slug, hydraulic conductivity of the formation, and type of well completion. Slug volume shall be large enough that a sufficient number of water level measurements can be made before water level returns to equilibrium. Length of test may range from less than a minute to several hours.

6. Continue measuring and recording depth/time until water level returns to equilibrium or, for slowly recovering wells, until a sufficient number of readings have been made to clearly show a trend on a semi-log plot of time versus depth.

7. If the FEMP project manager, EPA, and Ohio Environmental Protection Agency approve addition of water to the monitoring well, use water from an uncontaminated, tested source. Transport water in a clean, approved container.

8. Decontaminate bailers and measuring devices prior to the test as specified in Appendix K.

9. If tests are performed on more than one monitoring well, avoid cross contamination of wells by using decontamination procedures specified in Appendix K.

Aquifer Pumping Test - Aquifer pumping tests, commonly referred to as pump tests, are used to determine hydraulic properties of water-bearing zones. Pump tests influence a larger area and provide results that are often more representative of the overall aquifer characteristics than slug tests. Aquifer characteristics that may be obtained from pumping tests include hydraulic conductivity, transmissibility, and specific yield for unconfined aquifers and storage coefficient for confined aquifers.

Equipment, personnel, and time commitments needed for pumping tests are greater than those for slug tests. Constant-rate discharge, variable-rate, and injection tests are types that may be used. Test method and procedures shall be specified in the PSP.

Equipment needed for pumping tests includes the following items.

NOTE

> Pumps are commonly of the submersible or turbine type and are sized consistently with expected aquifer conditions. The well should be developed prior to testing.

- One or more completed observation well/piezometer hydraulically connected to the pumped test aquifer and completed to specifications for the particular test
- Orifice, weir, flow meter, container or other type of water measuring device to accurately measure and monitor discharge from the pumped well
- Pipe to transport pumped water from pumping well to holding tank or effluent location
- Valve on discharge pipe to control pumping rate
- Outlet valve near well head for water quality sampling
- Depth-to-water measuring devices for each observation and pumping well (may include steel tapes, electric sounding probes, Stevens recorders, or pressure transducers)
- Thermometer and other necessary water quality equipment
- Watches capable of reading to the nearest second, stopwatch, or pressure transducers with data loggers
- A 3-by-5-cycle log and 5-cycle semi-log graph paper or appropriate, verified computer software, and necessary hardware
- Indelible pens or pencils and form for recording times and drawdown measurements at each well
- Appropriate references and calculator for field determinations
- Barometer or recording barograph for tests conducted in confined aquifers

The following general procedure applies to pumping tests.

1. Prior to the test, monitor water levels in the observation well to measure diurnal fluctuations. (Number of wells and the monitoring period shall be specified in PSPs.)

2. Record the following information during the test.

   - Identification numbers or locations of pumped well and each observation well
   - Location and elevation of each well
   - Location and elevation of reference point from which water depth measurements are made and elevation of ground surface with respect to the reference point
   - Weather conditions
   - Method of measurement
   - Date and time of test
   - Well depth, pump depth, screen length, well radius, and radius of filter pack plus well screen for each well

3. Calibrate measuring equipment used for pumping tests before use.

4. Maintain calibration records that consist of laboratory measurements and on-site zero adjustment and/or calibration performed.

5. File copies of calibration documentation with test records.

6. When a weir or an orifice is used to measure flow rates, check it on site with a container of measured volume and stopwatch. Verify the accuracy of the meters before proceeding with the test. Check meters hourly during the test, and document each check.

7. Record changes in barometric pressure during the test, preferably with an on-site barograph, to correct water levels for fluctuations that may occur as a result of changing atmospheric conditions.

8. Measure water levels to provide data required to meet test requirements. Early in the test, ensure that sufficient personnel are available to collect at least ten measurements per log cycle (i.e., 1-to-10 and 10-to-100 minutes) at each selected observation well, or install a pressure transducer and data logger at each well to collect the data at the given frequency.

9. Measure water level recovery after pumping stops to verify results obtained during drawdown portion of the test. Measure recovering water levels in the pumped well and in observation wells for a period of time immediately following cessation of pumping.

10. Perform monitoring during recovery period as specified in PSP.

J.4.7 Well Maintenance

It is important to maintain groundwater monitoring wells in order to extend the life of the wells and provide representative levels and samples of groundwater surrounding the wells. The following aspects of well maintenance shall be addressed.

- Well evaluation
- Redevelopment
- Maintenance check lists
- Well head protection

The FEMP shall be responsible for well maintenance activities, conducting a maintenance survey of groundwater monitoring wells, and evaluating well maintenance aspects such as water quality, structural integrity, and well-head protection. Well maintenance activities shall comply with applicable regulatory and site requirements.

J.4.7.1 Well Evaluation. Existing groundwater monitoring wells shall be evaluated for the ability to provide representative samples and may include the following activities.

- On-site inspections
- Review of existing well installation documentation
- Review of well history (whether it produced consistently clear or turbid samples). (Wells with irreconciliable turbidity or lacking information on design and construction may be abandoned under circumstances described in paragraph J.4.3.4.)
- Review of groundwater sampling field records
- Down-the-hole camera inspections

- Review of other sources of information that may be applicable to a specific well
- Review of the hydraulic characteristics of the aquifer adjacent to the well that shall include pump and slug tests to determine the following.
  - **Pump Tests** - for aquifer characteristics, degree of hydraulic interconnection between different water-bearing units, and recharge rates
  - **Slug Tests** - for in-situ hydraulic conductivity of low-permeability formations through addition or removal of an inert solid of known volume

J.4.7.2 **<u>Well Inspection and Repair</u>.** The following procedure shall be conducted at each well as applicable to that specific well.

1. Ensure that guard posts are in good repair.
2. Inspect ground surrounding well for the following conditions and repair as required.
   - Ground must be free of depressions and channels that allow surface water to collect and flow towards well head.
   - Surrounding area must be clean of debris and foreign material that could leach contaminates into subsurface or otherwise interfere with well sampling.
3. Inspect locking lids for the following conditions and repair or replace as applicable.
   - Lid must open with minimal effort.
   - Eyelets on lid and protective casing must align for easy removal of padlock.
   - Ensure integrity of hinge and seal on lids, which must also serve as sanitary seal.
   - Padlocks must be free of accumulated debris within key slot and locking mechanism.
   - Padlocks must operate freely.
   - Padlocks must be installed with key-slot down to prevent rainwater from entering locking mechanism.
4. Inspect the well caps for the following conditions and repair or replace them as applicable.

- Cap must be free of spider and insect debris, molds, fungi, or anything that could affect representativeness of water samples.
- Above-ground caps must fit securely and vent hole must be clear.
- Ground-flush caps must be water-tight to prevent surface water from entering well.

5. Inspect protective casing for the following conditions and repair or replace it as applicable.

    - Structural integrity - Casing must be free of corrosion and cracks.
    - Casing must be reasonably plumb with ground surface.
    - Paint must be bright orange.
    - Well identification number must be painted in white or welded to the top of lid.
    - Drain hole must be clear allowing water caught between protective casing and well casing to escape.
    - Structurally sound concrete surface seal and pad around protective casing must be free of voids, cracks, and depressions where it contacts ground surface

6. Inspect well casing for the following conditions and repair as required.

    - Casing must be free of spider or insect debris.
    - Sharp edges - recondition edges as required.
    - Grout between well and protective casings must be free of cracks and structurally intact.

7. Inspect well and well records for the following conditions and remedy as appropriate.

    a. Well development and size of screen openings causing sediment accumulation at bottom of well - remove sediment that significantly affects well performance.

NOTE

For wells less than 25 feet deep, sediment may be removed using a centrifugal pump with an intake hose to suck sediment from well bottom. For deeper wells, a bailer or hose with a foot valve are suggested for sediment removal.

b. Accumulation of chemical, physical, or biological incrustation on well screens. Remove incrustation or replace screen as appropriate. Do not use chemicals to remove incrustation.

8. Evaluate wells for reduced yield by comparing present yield to installation data, previous yield, and past pumping tests.

9. Inspect wells for blockage caused by sampling equipment lodged in well (e.g., purge pumps and bailers). Evaluate removal of such equipment on an individual basis.

10. Prior to performing maintenance at a designated location, develop a PSP that provides the following information.

- Scope of maintenance activity
- Work schedule and completion date
- Manpower and materials required
- Decontamination procedures and other measures to ensure well integrity
- Decontamination procedures (Section 5) required for equipment that may enter the well casing or otherwise contaminate the well.
- Required documentation of field activities as follows:
    - Daily log (paragraph J.4.1) submitted to the FEMP within one day of task conclusion
    - Weekly progress reports including photocopies of log entries
    - Well abandonment report documenting compliance with applicable EPA and Ohio Environmental Protection Agency regulations and FEMP Sitewide CERCLA Quality Assurance Project Plan
    - Final report in specified format documenting evaluation and maintenance activities and addressing plan objectives

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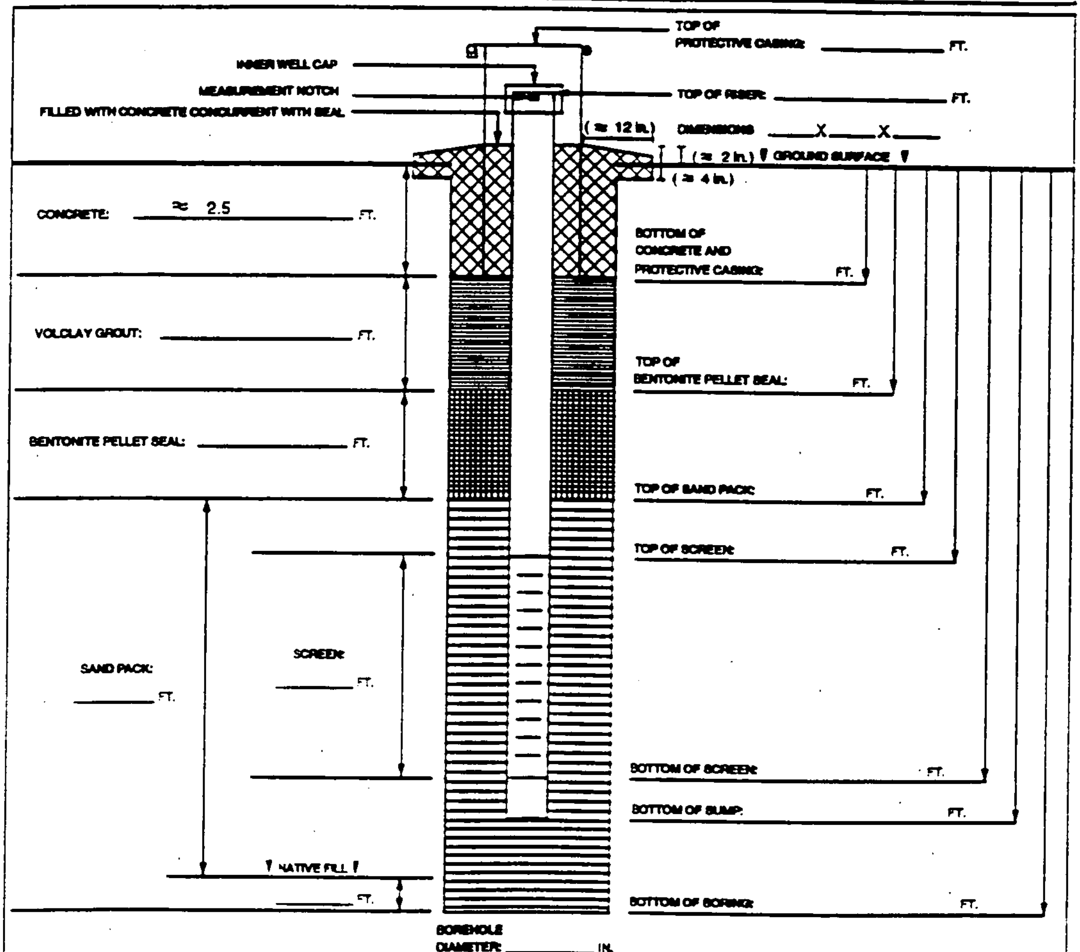
FEMP
WELL COMPLETION LOG

WELL NUMBER:	CONTROL NUMBER:
PROJECT NAME:	PROJECT NUMBER:
GEOLOGIST:	DRILLING METHOD:

DATES OF INSTALLATION:	WATER LEVEL:	DATE:	RELATED FAL NUMBERS:	CHECKED BY:



VOLUME AND TYPE OF GROUT USED:	BENTONITE PELLETS (5-GALLON BUCKETS):	DEEPEST TEMPORARY DRILLING CASING PENETRATION:
VOLUME OF WATER USED DURING DRILLING:	CASING MATERIAL:	DRILLING CASING DIAMETER:
CASING WALL THICKNESS:	VOLUME AND TYPE OF SAND PACK:	SCREEN MATERIAL:
RISER / SCREEN DIAMETER:	SCREEN SLOT SIZE:	SCREEN TYPE:

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Form J-2. Example Well Completion Log

- Well casing diameter from well construction diagram
- Calculated well volume
- Actual volume removed during purging and maximum rate of purge
- Estimated depth to pump intake at start and finish of pumping

6. If cleaning solvents or internal combustion engines are used at a site when a well is open, place them downwind of the well or far enough away that fumes are diluted beyond the detection limit of a calibrated Photo-Ionization Detector (PID) or Flame-Ionization Detector (FID). Locate the sampling vehicle downwind of the well.

7. Measure depth to groundwater in the well as specified in paragraph K.4.2.1. Measure total depth of monitoring well to the nearest 0.01 foot (U.S. Environmental Protection Agency, 1986a) and compare it to well installation information. If dedicated equipment is present in the monitoring well, then total depth measurement of the monitoring well is not possible.

8. Compare total depth measurement to depth indicated by well installation information to determine if silting into the screened portion of the well has occurred. If a discrepancy is identified or silting is discovered, immediately refer the matter to the FEMP project manager for resolution. Document the resolution.

9. Two methods for purging monitoring wells exist. The first is a standard purging method, which involves the evacuation of water from the well casing and screen. The second is micro-purge, which involves the evacuation of stagnant water from the dedicated pump and discharge line. (Fernald Environmental Restoration Management Corporation, 1993).

   a. Standard purge requires the evacuation of at least three times the amount of water in the well casing and screen with a stainless-steel submersible pump, stainless steel or teflon bladder pump, peristaltic pump, or teflon or stainless-steel bailer.

   b. Micro-purge requires the evacuation of a precalculated purge volume, which is two times the volume of water contained in the dedicated submersible pump and discharge line. Note that the flow rate must not produce draw down in the well, since this would produce mixing with the stagnant water column.

10. Upon purge completion:

a. For Standard Purge (removal of standard three volumes), take sets of pH, temperature, dissolved oxygen, turbidity, and specific conductance measurements until the results between measurements are consistent, then proceed with sample collection. See K.4.2.3 for sample collection procedures.

b. For Micro-purge (removal of a calculated micro-purge volume), take one set of pH, temperature, dissolved oxygen, turbidity, and specific conductance measurements prior to sample collection. See K.4.2.3 for sample collection procedures.

NOTE

A well in the Great Miami Aquifer is generally considered dry or having potential well bore damage if it does not recover sufficiently within 24-48 hours after development begins or if it does not yield a complete sample within 24 hours after purging. Due to relatively lower permeability of, or water supply in, perched water intervals of the overlying glacial till, full development may require several days or longer.

11. Do not take samples from dry wells. Document well condition on field log.

12. Evacuate monitoring well if it can be pumped or bailed dry and allow it to recover prior to sample withdrawal. The evacuation rate shall be low enough to prevent excessive agitation of recharge water (U.S. Environmental Protection Agency, 1986a) based on hydraulic characteristics of the well. Avoid excessive pumping that can cause samples to be non-representative.

13. If the standard purge method is used on a monitoring well prior to sample collection, lower pump intake to a depth of five to ten feet below water level in the casing but above well screen where possible. Initially purge well from this depth so that fresh water from screened interval will move upward through casing and completely flush well. Ensure that pumping rate is low enough to prevent significant agitation and that it is less than maximum pumping rate used during monitoring-well development.

14. If pumping of air (caused by excessive drawdown of the well water level) occurs, reduce pumping rate. If it continues, lower pump intake five to ten feet within the well if possible and reduce pumping rate further to prevent excessive drawdown.

15. If the potential for surface contamination exists and equipment is removed from the well, then place the equipment on a plastic sheet to avoid equipment contamination.

CAUTION

Do not allow release of any evacuated water to the environment.

16. Collect water produced during of monitoring wells in appropriate containers.

17. Collect excess water generated g sampling of monitoring wells in appropriate containers.

18. Retain evacuated water (if free of constituents classified as RCRA hazardous waste based on past sampling data) in appropriate containers until disposal into the FEMP general sump.

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